Carolina Planning

Are we in the right lane?

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Carolina Planning is a student-run publication of the
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From the Editors

The editors of *Carolina Planning* are pleased to offer this issue, which focuses on current topics in transportation. Transportation decisions at all levels of planning, from neighborhood to national, concern the efficient and safe movement of goods and people. This issue highlights examples of each of these levels of planning, while shedding light on how they are interconnected.

In the opening article, recent DCRP graduate Matthew Day writes about bicycle and pedestrian mobility in downtown Chapel Hill. Using traditional level of service methods, he assesses the perceived comfort level of non-motorist users. In the second article, Julian Benjamin of NC A&T State University compares the experiences of different cities that are using High Occupancy Toll (HOT) lanes on major highways. Next, Terry Chastain from the Metro Atlanta Chamber of Commerce presents the case for the creation of a high-speed rail in the Southeastern U.S. that would stretch from Washington D.C. to Birmingham and feature stops in both Charlotte and Raleigh. Finally, Greg Saathoff, from the University of Virginia, and John Noftsinger, from James Madison University, explain why our interstate highways may not be suitable for a mass evacuation in response to a terrorist attack.

This issue also includes an inteview with Janet D'Iganzio from the Center for Transportation and the Environment, who has been involved in transportation planning at the local, state, and regional levels. She offers her insights into the future of North Carolina's transportation systems.

We invite readers to respond to our content and design and to submit manuscripts for publication in future issues. Thank you for your continued support.

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Level of Service Measures for Biking: A Comparative Analysis of Calculation Methods

Matthew M. Day, MRP

Abstract

Traditional methods for computing level of service (LOS) have implicitly favored mobility at the expense of accessibility. The LOS concept was developed by highway engineers in the 1950s as a method of measuring the level of mobility provided by a certain facility (FDOT, 2002). It has been applied in recent years to alternative transportation modes such as walking, bicycling and public transit. This article analyzes and compares the results of applying several of the LOS methods that have been developed for alternative transportation modes to a study area in Chapel Hill, North Carolina.

Introduction

Traditional methods of measuring the level of service (LOS) focus narrowly upon mobility, as determined by the relationship of facility capacity to volume of traffic, while ignoring accessibility. In the field of transportation planning, mobility has been defined as the ability to get from one place to another (Hansen, 1959; Handy, 1994). Accessibility, by contrast, has been defined as the potential for interaction. In other words, mobility is a measure of how easily a user can move through a facility; accessibility, on the other hand, measures how easily a user can reach a destination using a facility.

When accessibility is low, a person's ability to reach a destination is compromised. Traditional LOS measures do not capture this effect. Under traditional LOS measures, corridors with high levels of mobility will score high on traditional LOS methods, regardless of whether they offer accessibility. In many cases a facility will offer high mobility but low accessibility, or vice versa. For example, a community with abundant roads and little congestion but with relatively few destinations for shopping or other activities displays poor accessibility but good mobility. An area featuring high levels of congestion but relatively short distances between where residents live and all needed and desired destinations has good accessibility but poor mobility.

A more accurate measure of level of service would consider both the mobility and accessibility offered by a facility (Levine and Garb, 2002). Recently, new LOS methods emphasizing accessibility have been developed. These new measures allow planners, engineers, and others to determine the accessibility offered by a broad range of transportation facilities,

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including roadways, transit facilities, and facilities constructed for pedestrians and bicyclists.

This paper uses a selection of accessibility-based LOS measures that have been developed for pedestrian, bicycle, and transit facilities to analyze the downtown area of Chapel Hill, North Carolina, (see Figure 1) where traffic levels are low and walking, biking, and public transit are popular modes of moving from place to place.

Figure 1. Franklin Street in Chapel Hill, NC is a pedestrian and bike-friendly roadway. *Photo by Helen Chaney.*

Capacity-based LOS standards

The *Highway Capacity Manual* (*HCM*) is the standard methodological guide in the United States for computing automobile level of service (FDOT, 2002). For modes of transportation other than private automobiles (for which the *Highway Capacity Manual* method, though flawed, is generally used), there is less agreement among transportation planners and engineers as to an acceptable approach for computing level of service. The Transportation Research Board (TRB) has developed a *Transit Capacity and Quality of Service Manual* (*TCQSM*) that outlines many different methods of computing LOS for transit services based on capacity/mobility, accessibility, and quality measures (Kittelson, 1999). Some authors suggest that characteristics of the built urban environment (Jaskiewicz, no date) or the social or policy environment (Hoehner et al., 2003) are also factors that influence the level of service that a person perceives on a particular non-automobile facility.

Non-capacity Level of Service Models

Several accessibility-based LOS models have been developed to evaluate bicyclist and pedestrian perceived safety with respect to motor vehicle traffic and comfort in using the roadway corridor.

The most popular methods for determining Pedestrian Level of Service (PLOS) include the PLOS method, developed by Sprinkle Consulting, and the Fruin PLOS method, which is included in the *Highway Safety Manual*. Emerging national standards for evaluating the bike-friendliness of a roadway are the Bicycle Level of Service (BLOS) method, developed by Sprinkle Consulting, and the Bicycle Compatibility Index (BCI), developed by the Federal Highway Administration (FHWA). The Transit Level of Service (TLOS) method, developed by the Florida Department of Transportation, computes level of service based on availability of transit within a walking distance. Each of these five methods are described in detail in the following sections. While some of these models focus upon travel demand and facility capacity, others are based upon a wider range of factors, such as accessibility, environmental quality, and safety.

LOS methodolgies for pedestrian and bicyclist travel can be useful to planners in a variety of ways. These tools can help planners to identify weak links in a network of sidewalks or bicycle facilities, for example. Using the results of these models, planners can work to

prioritize sites needing improvement. Planners can use the bicycle LOS measures to determine which routes to include in the bicycle network. They may also use the measures to create a bicycle map, which can help the public in choosing which routes to take.

Pedestrian Level of Service Method, developed by Sprinkle Consulting

The Florida Department of Transportation (FDOT) uses a methodology for computing pedestrian level of service that was created by Sprinkle Consulting and is based on four major physical characteristics of the street and sidewalk space: presence of a sidewalk and lateral separation from street; motor vehicle volume; traffic speed; and driveway traffic volume and access frequency (Landis et al., 2001). The creation of the model involved a survey and a regression analysis of the survey results. The firm first conducted a pedestrian facility quality survey in Pensacola, Florida, asking users about environmental factors, including width of sidewalk, width of bike lane, presence of sidewalk buffer, volume and speed of traffic, and number of traffic lanes, among others.

Second, the firm analyzed the results of the survey using a regression analysis, in order to determine which environmental factors were most closely related to the users' perceived quality of the facilities (FDOT, 2002). In a later study, the firm sought to determine whether two other factors—the presence of other pedestrians and the presence of buildings against the edge of a sidewalk—were related to the perceived quality of pedestrian facilities, but they found that no such relationship existed.

The PLOS method is focused primarily upon physical characteristics of the roadway and sidewalk environment, and it provides a simple method for computing LOS along a segment of the road/path network. This method was chosen because it is relatively objective and easily converted into a uniformly-applicable level of service measure.

The basic equation that this PLOS method utilizes is (FDOT, 2002):

$$PLOS = -1.2276 \ln(Wol + Wl + fp * \%OSP + fb * Wb + fsw * Ws) + 0.0091(Vol15 / L) + 0.0004 * SPD2 + 6.0468$$

(for English units)

where,

Wol = width of outside lane of traffic (including on-street parking area);
Wl = width of marked shoulder or marked bicycle lane;
fp = on-street parking coefficient or factor (0.2 used in analysis);
%OSP = percent of segment with on-street parking;
fb = sidewalk buffer factor;
Wb = width of buffer between street and sidewalk;
fsw = sidewalk coefficient or factor (equals 6 - 0.3 * Ws);
Ws = width of sidewalk;
Vol15 = volume of directional motor traffic in peak 15-minute period;
L = number of directional through lanes;
SPD = average speed of motor vehicle traffic.

Under the PLOS method, LOS is calculated for both sides of each road segment being studied; grades are based on the scale on the following page.

LOS Grade	PLOS/BLOS Score
A	< 1.5
B	1.5 - 2.5
C	2.5 - 3.5
D	3.5 - 4.5
E	4.5 - 5.5
F	> 5.5

Fruin Pedestrian Level of Service Method, developed by Fruin and included in the Highway Capacity Manual

The Fruin method, which requires the input of pedestrian count data, can provide useful information about the capacity of the sidewalks in high-traffic locations, and determine whether there is a need for additional sidewalk capacity in these locations.

The Fruin methodology is defined by the following equation (TRB, 2000):

Pedestrian unit flow rate = V15 / (15 * We)
where,
V15 = peak 15-minute pedestrian traffic rate (persons per 15-minutes);
We = effective width of sidewalk.

The flow rate generated by the equation above is used to determine a LOS grade for a pedestrian facility based on the standards below.

LOS Grade	Flow (persons/min/ft)
A	< 5
B	5 - 7
C	7 - 10
D	10 - 15
E	15 - 23
F	> 23

The Fruin method is a capacity-based method and assumes that the primary determinant of quality service in the pedestrian environment is the ability to move through that environment with as little impedance as possible.

Bicycle Level of Service Method, developed by Sprinkle Consulting

Sprinkle Consulting developed a BLOS method for the Florida Department of Transportation. This method, like Fruin's, is based upon physical characteristics of the road and bicycle facilities but focuses to a greater extent than the Fruin method upon the presence and quality of bicycle facilities and the characteristics of motor vehicle traffic, including the volume, speed, and number of heavy trucks (see Figure 2). The various data are combined into a LOS score based on a regression model (FDOT, 2002).

Figure 2. The quality of bike facilities, such as bike lanes, may affect a cyclist's BLOS. *Photo by Erik Malkemus.*

This particular method includes a factor on roadway condition, which is a variable not included in the BCI method (discussed below). Other factors include motor vehicle traffic volume and speed, effective outside lane width, and amount of truck traffic.

Bicycle Level of Service is defined by this model as (FDOT, 2002):

BLOS = 0.507 ln(Vol15 / L) + 0.199 * SPt * (1 + 10.38 * HV)2 + 7.066 * (1/PR5)2 - 0.005 * We2 + 0.760 (for English units)

where,
Vol15 = volume of directional traffic in 15-minute peak period;
L = total number of through lanes;
SPt = effective speed limit (1.1199 ln(SPp-20) + 0.8103, SPp = posted speed);
HV = percent heavy trucks;
PR5 = FHWA 5-point surface condition rating;
We = average effective width of outside lane (lane width less obstructions).

Level of service grades are assigned for both sides of each road segment being studied using the same scale as for the PLOS model (see previous).

Bicycle Compatibility Index Method, developed by the Federal Highway Administration

The Federal Highway Administration (FHWA) has developed a BCI that serves as a measure of quality for different roads in terms of bicycle traffic. The BCI is similar to the aforementioned FDOT pedestrian and bicycle level of service methods, in that it primarily focuses on physical characteristics of the road, such as the presence of bicycle lanes or the volume of automobile and truck traffic, and combines them into a measure of facility quality that is not based entirely on capacity (FHWA, 1998). While the FDOT and FHWA methods of computing BLOS examine similar characteristics of the bicyclist's environment, the two models use different criteria weights and could produce very different results. The FHWA method is different from the Sprinkle BLOS method in that it accounts for the presence of a bicycle lane, the traffic volume in lanes other than the outside lane, and the presence, occupancy, and turnover of on-street parking.

The BCI uses the following equation to compute level of service (FHWA, 1998):

BCI = 3.67-0.966 * BL-0.410 * BLW - 0.498 * CLW + 0.002 * CLV + 0.0004 * OLV + 0.022 * SPD + 0.506 * PKG - 0.264 * AREA + AF
where,
BL = presence of bike lane (no = 0, yes = 1);
BLW = bicycle lane width (meters);
CLW = curb lane width (meters);
CLV = curb lane volume (peak hour);
OLV = other lane(s) volume in same direction (peak hour);
SPD = 85th percentile of speed;
PKG = presence of parking lane occupied more than 30% (no=0, yes=1);
AREA = type of development (residential=1, other=0);
AF = truck volume factor + parking turnover factor + right turn volume factor.

The grading scale for the BCI is presented later, along with a discussion on a proposed adjustment to the grading scale as a result of the analysis conducted in Chapel Hill.

Transit Level of Service Method, developed by the Florida Department of Transportation

The Florida Department of Transportation uses a sophisticated method for determining transit level of service at the system, route, and stop levels. FDOT's method is built upon the framework set up in the Federal *Transit Capacity and Quality of Service Manual*, which suggests measuring transit accessibility by service frequency, hours of service, and service coverage. This TLOS method takes into account these factors and uses a free downloadable computer program, Geographic Information Systems (GIS), and spreadsheets to compute LOS based on availability of transit within a walking distance (based on a walking network), given vehicle headways, and projected wait times for individual routes and stops (Ryus et al., 2000). It should be noted that the TLOS does not address whether routes connect origins and destinations well, or whether transit customers are comfortable and safe on their trips.

The transit level of service in the Chapel Hill Town Center will be determined using a form of the Florida Department of Transportation's TLOS methodology. The full version of the TLOS software is a somewhat burdensome program to use and requires a great deal of data that is not always immediately available to the public; however, the program, which is downloadable from the Internet at no cost, comes with a spreadsheet that allows for a simplified calculation of LOS for route segments and stops. The spreadsheet has few data requirements. One can obtain a complete output by inputting only the scheduled arrival and departure times of buses—information which can be easily obtained from a schedule book.

The TLOS route segment spreadsheet allows a user to input the names of stops along a street segment, the routes operating along that segment, and the times that buses are scheduled to stop at the stops along the segment. A macro built into the spreadsheet then calculates the number of minutes during the day that a stop has service available to it, based upon a number of variables, including user-defined maximum wait times at stops, walking distances, environmental characteristics, and the use of straight-line or network-based buffers.

Level of service can be computed two different ways using this spreadsheet because the user defines the time duration of the calculations. If the user only calculates TLOS for a portion of the day (i.e., during the time of service), the program defines a letter grade based on the frequency of service guidelines in the *Transit Capacity and Quality of Service Manual*, shown below (Kittelson, 2001 and 1999).

LOS	TLOS Score (% time served)	Headways* (*TCQSM*)
A	> 50 %	< 10 minutes
B	35.7% - 50%	10-14 minutes
C	25% - 35.7%	15-20 minutes
D	16.7% - 25%	21-30 minutes
E	8.3% - 16.7%	31-60 minutes
F	< 8.3%	> 60 minutes

*assumes 5 minute maximum wait time

See Figure 3 for a graphic representation of TLOS scores for the Chapel Hill transit system.

On the other hand, if the user defines the calculation period as exactly 24 hours, the LOS grade is determined jointly by frequency and hours of service. This is done by simply multiplying the TLOS score standards (in terms of percent time served) together to create a joint standard. For example the "A" standard for headways is less than 10 minutes and the standard for hours of service is greater than 19 hours. Headways of minutes, assuming 5 minute wait times, mean that a location is served 50 percent of the time. Being served 19 hours out of 24 means being served 79 percent of the time. Seventy-nine percent of 50 percent is 39.6 percent, so any TLOS score over 39.6 percent would receive a grade of "A." The following table summarizes the standards for 24-hour TLOS grading (Kittelson, 2001 and 1999).

LOS	TLOS Score (TCQSM)	Headways (TCQSM)	Hours Served
A	> 39.6%	< 10 minutes	19-24
B	25.3 - 39.6%	10-14 minutes	17-18
C	14.6 - 25.3%	15-20 minutes	14-16
D	8.4 - 14.6%	21-30 minutes	12-13
E	1.4 - 8.4%	31-60 minutes	4-11
F	< 1.4%	> 60 minutes	0-3

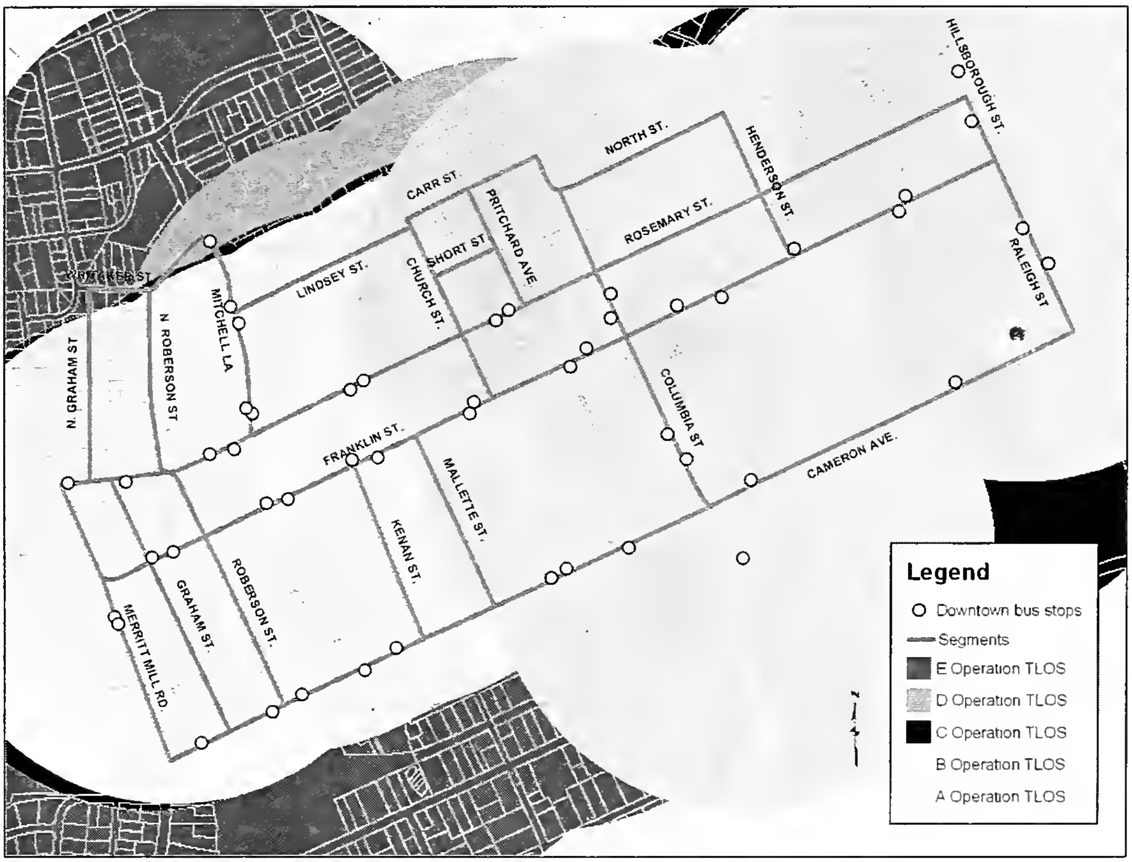

Figure 3. Example of buffers used in TLOS software that outline areas of Chapel Hill's transit service with different grades of TLOS operation. *Image courtesy of Matthew Day.*

For simplicity in calculating TLOS for this comparative study, environmental values for the areas surrounding stops were not calculated. Calculating environmental values would have required the data on pedestrian facility quality as well as job and population density around stops. When such environmental data are included in an analysis, the researcher weighs the stops according to the data. When such environmental data is not included in the analysis, all stops are weighted equally.

Methodology

This analysis involves computing level of service for the various modes of transportation in the Town Center area of Chapel Hill using the methods outlined in the above literature review as a means of discovering the applicability and benefits of existing LOS methodologies.

Chapel Hill is a small city in the Piedmont region of central North Carolina and is included in the Research Triangle region (Raleigh-Durham-Chapel Hill). Chapel Hill's Town Center essentially centers around two streets, Franklin Street and Rosemary Street, which run parallel to one another. Traffic levels are low in the downtown area, due in large part to a scarcity of parking and a 20 mph posted speed limit. Walking, biking, and public transit are popular forms of transportation in this area. The University of North Carolina's main campus is at the eastern end of the Town Center. The Town of Carrboro lies directly to the west of Chapel Hill.

For the purposes of this analysis, a study area was defined that extended one block from the south side of Franklin Street and from the north side of Rosemary Street. The streets in this study area were broken into segments, which generally spanned from one intersection to the next intersection, with a few exceptions. Data used in the analyses included GIS parcel data, aerial photographs, pedestrian and vehicle traffic counts, and GIS bus stop location data. Traffic counts on individual street segments were estimated based on known traffic counts and estimated trip ends per segment.

In an effort to compare different methods of computing level of service, two different methods have been used for each mode of travel being studied. For pedestrian level of service, the PLOS method developed by Sprinkle Consulting is compared with the capacity-based Fruin method, which is the method presented in the *Highway Capacity Manual*. For bicycle level of service Sprinkle Consulting's BLOS calculation is compared with the Federal Highway Administration's BCI calculation. Finally, for transit level of service, a simplified version of Florida's TLOS method is used. The TLOS method includes two methods of calculations—one which is based upon frequency of service and another which is based on frequency and hours of service. Both of these TLOS methods are employed in the analysis.

Findings

Pedestrian Facilities

The two methods utilized for calculating pedestrian level of service yielded widely divergent results. The Fruin method paints a picture of excellence in Chapel Hill's pedestrian environment. All of the locations for which the Fruin method was applied received a LOS grade of "A." The PLOS model, on the other hand, provides a more varied picture. PLOS grades for the town center ranged from "A" to "E," with most facilities falling in the middle of the range ("B" or "C").

The variation in scores produced by the two models undoubtedly results from their varied approaches. The

Fruin method, being a capacity-based method, bases its LOS grades entirely on the volume of pedestrian traffic and the capacity of a pedestrian facility. The Fruin analysis, which was conducted on the locations in the Town Center study area for which there were recent pedestrian volume counts, produced a result of all "A's" for pedestrian facilities in the area.

While both models are helpful in evaluating the LOS of pedestrians in Chapel Hill, each model is based upon assumptions which are somewhat incompatible with the Chapel Hill environment. The Fruin method is a capacity-based method and assumes that the primary determinant of quality service in the pedestrian environment is the ability to move through that environment with as little impedance as possible. In Chapel Hill's Town Center, where pedestrian flows are steady, but certainly not crush flows, every pedestrian facility will score an "A" (flow is uninterrupted). Clearly, this has little utility for determining the quality of the pedestrian environment in this situation of examining residential and commercial streetfronts. The method seems better suited to determining adequacy of pedestrian facilities at airports, stadiums, and schools, where one would expect very large crowds at certain peak times.

The PLOS method, by contrast, calculates scores based upon characteristics of the pedestrian environment. Like most level of service models, the PLOS model was developed primarily for use on arterial highways. As such, the assumptions upon which the model is based do not logically apply to local residential streets. For example, one assumption of the PLOS is that pedestrians do not walk in the street, but walk, instead, beside the road—either on a sidewalk or on the grass. Experience tells us, however, that many people in Chapel Hill walk in the street on low-volume roads which do not feature sidewalks. The PLOS model assumes the cars always act as a buffer. As such, the PLOS model gives high grades to side streets where on-street parking is present. In reality, streets in Chapel Hill featuring on-street parking and no sidewalks constitute a less-safe pedestrian environment, as pedestrians are forced to walk further into the street. This problem occurs on several streets in the Town Center study area. To account for this inconsistency, we must assume that for streets where there is no sidewalk but there is on-street parking, both sides of the street should have a LOS grade that is close to that found on the side of the street that does not have on-street parking.

Bicycle Facilities

The two methods used for examining bicycle level of service models show that bicycle level of service is lowest in the areas immediately surrounding the University of North Carolina campus.

The results of the Sprinkle Consulting BLOS method portray a relatively safe bicycling environment in much of the Chapel Hill Town Center. Most areas north and west of the intersection of Franklin and Columbia Streets (the de facto center of town) received a score of at least "C." Areas around the edge of the UNC campus, however, received grades of "D" and "E" for the large part. These grades are given in each direction, since bicycle traffic flows in the same direction as motor vehicle traffic, on the right-hand side of the street.

The results in the test case generally show lower scores on roads with high traffic volumes and narrow outside lanes. Locations with on-street parking also generally have lower scores than those without on-street parking, because this parking is an obstruction and potential hazard to bicycle traffic, especially if there is high parking

turnover. None of these road segments contain striped bicycle lanes, which also leads to the lower scores.

The Federal Highway Administration's BCI method produced a similar pattern of results to the BLOS method, but generally resulted in lower grades. The BCI also found the most deficient areas to be those near the university campus, but found the Town Center to be more deficient overall. Only Rosemary Street and a few residential streets have consistently passing scores, and no segments in the study area received a BCI grade of "A."

The BCI results are heavily influenced by the weighting of the factors in the BCI model. This model includes more input factors than the BLOS model, which would suggest that it might be a more accurate representation of actual conditions. The BCI model, however, seems to have results that are very suspect. It may seem surprising that a low-volume side street could receive a level of service grade of "D." This result in the test case is caused by the heavy weight that the BCI model gives to the width of the roadway. Considering that many of these side streets are narrow, the model has ascribed to them a low score.

This points at the same issue noted in the section above pertaining to the PLOS model: these level of service methods were created primarily for use on arterial highways, not on side streets. The results of the BCI model still have some utility. They point to locations that could certainly be improved in terms of the bicycling environment. However, they are not as useful as the BLOS results for determining mitigation priorities because of the skewed results of the analysis.

Based upon the results calculated, the BCI grading scale seems inadequate for explaining bicycle level of service on minor side streets. Almost all side streets in the study area received very low grades under the initial grading scale for the BCI method, due to the relatively low weight the BCI places on traffic volume and the high weight it places on lane width and the presence of bicycle lanes which are generally not found on minor streets. For this reason, a modified grading scale presented below was developed for low-volume residential streets. In general, the low-volume road BCI grading scale that was developed simply increases the acceptable BCI score for each corresponding letter grade. This was determined to be a simpler, albeit a less methodologically-sound, method of modifying the BCI than attempting to modify the BCI equation itself. This grading scale was developed somewhat arbitrarily. However, with the original data used in developing the BCI, it might be possible to generate a less arbitrary revised grading scale for low-volume roads.

LOS Grade	High-volume (original) BCI score	Low-volume (adjusted) BCI score
A	< 1.50	< 2.0
B	1.51 - 2.30	2.01 - 3.0
C	2.31 - 3.40	3.01 - 4.0
D	3.41 - 4.40	4.01 - 5.0
E	4.41 - 5.30	5.01 - 6.0
F	> 5.30	> 6.0

Transit Facilities

As a baseline determination of level of service, a simple one-fourth mile buffer analysis for each bus stop in the Town Center was performed. The entire study area was determined to be within one-fourth mile of a bus stop. Traditionally, a determination of the quality of bus

service in an area would stop at this point. Based on this simple spatial accessibility analysis alone, the Chapel Hill Town Center appears to have excellent transit service (refer back to Figure 3).

The route segment worksheet in the TLOS software offers two methods for computing transit level of service. First, a 24-hour level of service can be determined based on service frequency and hours of service standards in the *TCQSM*. Second, an operation-period level of service can be determined based only on service frequency during the hours that a route is in service. The two methods produce similar, but slightly different results. Using a GIS program, it is possible to graphically display the results and find spatial patterns and differences in the results generated.

An examination of the 24-hour TLOS accessibility results for Chapel Hill reveals that service coverage is actually very good in the Town Center. While some corridors may not have good service, there is good service nearby on parallel corridors. Mapping the TLOS spreadsheet results in GIS allows recovery of the spatial analysis that is lost by using the simple spreadsheet instead of the full TLOS program to compute level of service. Almost all of the Town Center study area falls within one-fourth mile of a transit stop with a TLOS of "B" or better—only the far northwest corner of the study area has poor accessibility to good transit service.

The operation-time TLOS analysis produced similar results. The corridor and stop locations that do not meet a minimum standard of TLOS "C" are identical—the accessibility results are almost identical to the results for the 24-hour TLOS/accessibility. The main difference between the two methods is in determining the level of service along Franklin Street, which is the main street through the study area. The operation-time analysis shows that during the time buses operate along Franklin Street, the frequency of service is not as good in the westbound direction as in the eastbound direction. Information such as this could be useful in shifting bus schedules to maximize headway efficiency in this corridor.

Conclusion

Pedestrian, bicyclist, and transit service quality vary widely across the Chapel Hill Town Center. Levels of service vary from "A" to "E" in all modes of transportation. There is certainly an opportunity for the town to improve conditions in low-scoring areas, and several potential mitigation measures can be determined based on the factor values and data used in the various LOS models. Potential mitigation strategies include the addition of sidewalks and bicycle lanes, the addition or removal of on-street parking, the spatial and temporal addition of transit service, and other physical improvements. Many of these mitigation measures, which are designed to allow a segment to reach a passing grade in one of the level of service methods, are at odds with mitigation measures suggested by other level of service models. For example, a PLOS grade can be improved by adding on-street parking, but a BLOS grade is improved by removing the parking. While it is possible to continue adjusting mitigation strategies in each model so the strategy suggested in one does not conflict with that of another model, it would be useful to have a standard method for combining the various models across the different modes of travel to ensure that the needs of users in each mode can be met by a proposed mitigation measure. This type of model integration would also allow for a holistic approach to prioritizing improvement projects, since automobile, bicycle, and pedestrian improvements to roadways tend to be made simultaneously.

Level of service can be a very useful conceptual technique for quantifying the quality of a transportation facility. LOS does have its drawbacks as a quality measure, though. Depending on what characteristics are used to determine level of service, the results can be very biased or skewed. Traditionally, LOS has been used to describe the flow of motor vehicle traffic and level of congestion on roads. Here, however, this concept has been successfully applied in a way that determines service quality for modes of transportation other than private motor vehicles. These methods are not based on capacity and traffic flow, as the highway LOS methods are, but instead on environmental characteristics, accessibility, and other diverse measures of service quality rather than simply ease of use. Whether these methods adequately capture all the variables that affect the quality of a transportation facility is debatable, but they do at least get beyond the simple traditional notion of demand/capacity-based level of service.

The level of service models used in this analysis were developed for many purposes. The BLOS, BCI, PLOS, and Fruin methods were developed largely to determine the adequacy of pedestrian and bicycle facilities along arterial highways and other main roads, similar to the *Highway Capacity Manual* method of calculating automobile LOS (which is generally applied to major streets as part of the metropolitan planning process). The TLOS route spreadsheet method determines the adequacy of transit service frequency and hours of service (although the full TLOS method also accounts for environmental factors such as the sidewalk network and density of residents and employees in an area). Necessarily, these methods are not able to account for all factors that influence the quality of service on a given transportation facility. The differences in LOS scores derived from the different methods used in this analysis show that there is some need for integration of factors and methods to determine a standard method for computing level of service for alternative transportation facilities. While beyond the scope of this paper, future research could be done to determine whether additional factors could be added to these calculations, as well as determine how to integrate these various methods and the factors used in each method.

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Value Pricing Roadways

Julian Benjamin, Ph.D.

Abstract

Traditional congestion pricing strategies are meant to reduce demand on heavily congested roads by charging every user a toll during times when the facility experiences congestion. Value pricing refers to the practice of requiring drivers to pay the right toll for the first class service of a guaranteed congestion-free lane. This article describes the successful implementation of four such programs launched in California and Texas: State Route-91 in Orange County, CA, I-15 in San Diego, CA, and the I-10 Katy Freeway and US 290 Northwest Freeway in Houston, TX. The article also describes a current ongoing effort to research value pricing projects in North Carolina.

Introduction

Traditional congestion pricing strategies are intended to reduce demand on heavily congested roads by charging every user a toll during times when the facility experiences congestion.

When properly implemented, High Occupancy Toll (HOT) lanes provide a less congested lane, which helps reduce travel time and increase driving ease. Such schemes are intended to better balance the private benefits of automobile use with its social and environmental costs. Research shows that congestion pricing can serve to persuade people to carpool, vary the times they travel, alter their routes, choose other destinations, change the departure time and avoid or combine trips (TRB, 1994). In several cases, value pricing has been applied to High Occupancy Vehicle (HOV) lanes in order to increase their usage and the overall throughput on the roadway without reducing the incentive to rideshare.

Four original HOT lane facilities are currently in operation. These include SR-91 in Orange County California, I-15 in San Diego, and the I-10 Katy Freeway and US 290 Northwest Freeway in Houston. This article describes the successful implementation of each of these four projects and describes a current ongoing effort to research the feasibility of a value pricing project along I-40 in North Carolina.

Legal Authority for Value Pricing

Legal authority for exemplary projects is provided at the Federal level by the Value Pricing Program included by Congress in the 1998 TEA-21 legislation. In reauthorizing the program (originally specified in the ISTEA legislation of 1991) as a pilot program, Congress recognized value pricing as a new and innovative approach to congestion relief and noted the need to for

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more information on its effectiveness in different urban settings. Both technical and financial support is provided to support state and local efforts to plan, implement, manage, evaluate, and report on value pricing initiatives (FHWA, 1998). State legislation may be needed, for one or more of the following: (1) to permit conversion of existing HOV lanes to HOT lanes, (2) to permit charging a fee to use a state highway, and (3) to permit enforcement via video and electronic means.

The implementation of a value pricing program may entail numerous benefits and costs, as described in the next sections.

Benefits of Value Pricing

Reduced congestion in general purpose lanes—The impact of HOT lanes upon traffic congestion will differ depending on local conditions, particularly the level of latent demand and the availability of alternate routes.

Overall optimization of facility usage—Value pricing lane projects have resulted in overall improvements in speed and throughput. Value pricing spreads peak demand over a longer period, thereby smoothing the flow of traffic. A shift in a relatively small proportion of peak-period trips can lead to substantial reductions in overall congestion.

Easily fine-tuned user charges preserve free flow conditions—Under value pricing, user charges are set at a level that is expected to produce the desired effect of congestion relief while maintaining sufficient usage of the facility (Hyman and Mayhew, 2002). Variable pricing based on time of day (SR-91) or both time of day and volume has proven effective in shifting demand and maintaining free flow on the value priced lanes.

Reduction of new construction in conversion of existing HOV lanes—Conversion of existing HOV lanes to HOT lanes requires much less road infrastructure investment than building to meet demand, by using existing capacity more efficiently.

Provision of a less congested path for transit and emergency vehicles—Under value pricing, transit vehicles gain access to a faster-moving lane, giving them a competitive advantage over auto use in the regular lanes. This possibly may lead to a shift in travel mode choice, away from the automobile and toward public transit. Emergency services benefit from the implementation of value pricing, as it allows them access to a less congested path.

Additional revenue to pay for transportation improvements—Experience shows that HOT lanes are capable of providing adequate revenue to fund operations, and possibly pay for a portion of capital expenses. The Inland Breeze bus service along San Diego's I-15 exemplifies how HOT lanes can generate revenue to improve alternate modes of transportation.

Reduction of harmful externalities—Improved traffic flow reduces air pollution, incidents, noise levels, and fuel consumption.

Costs relating to Value Pricing

Significant investment in technology—Toll infrastructure requires significant up-front investment in electronic equipment, communications, accounting software and personnel, public information, and management.

Enforcement—Enforcement is needed at each entrance and exit point. Camera enforcement is the only safe

and cost-effective method of addressing toll violations under current conditions.

However, if carpools were allowed to use the facility for free or at a discount, manual "credit" would need to be provided via a manned facility at some location in the corridor because camera technology does not exist for accurately determining the number of persons in a vehicle.

Safety concerns—Implementation of HOT lanes without barrier separation may pose a safety hazard, as it results in more traffic in the inside lane and increases the propensity of drivers to weave in and out of lanes at will. Concrete barriers help to improve safety by eliminating random ingress/egress problems but may also limit access by police and emergency vehicles.

Political opposition to tolls or variable pricing—Those seeking to implement value pricing policies often encounter intense political opposition, as the policy adds a price to something that was previously regarded as a free good (Hau, 1992).

Equity—One major concern surrounding HOT lanes is that lower income populations will not be able to afford to use these lanes.

An Overview of New Projects

A list of current value pricing projects is presented in Table 1 on the following page. In addition to traditional HOT lanes, other concepts being demonstrated include "cordon tolls," which are charged when vehicles enter the perimeter of a restricted area. In addition, "fair lanes" are HOT lanes that include a method of income transfer to make the tolled lanes available to people who have low incomes. Also included are existing facilities with congestion pricing variations in the toll rate. Usage-based tolls are based on the distance traveled.

Existing HOT Lane Projects

Currently, HOT lanes are in operation in four areas around the United States. The following section provides a description of each.

State Route-91, Orange County, CA

The State Route-91 Express Lanes project added four new lanes for ten miles to the wide median of the Riverside Freeway at a total capital cost of $130 million (see Figure 1). The project is unique because it was

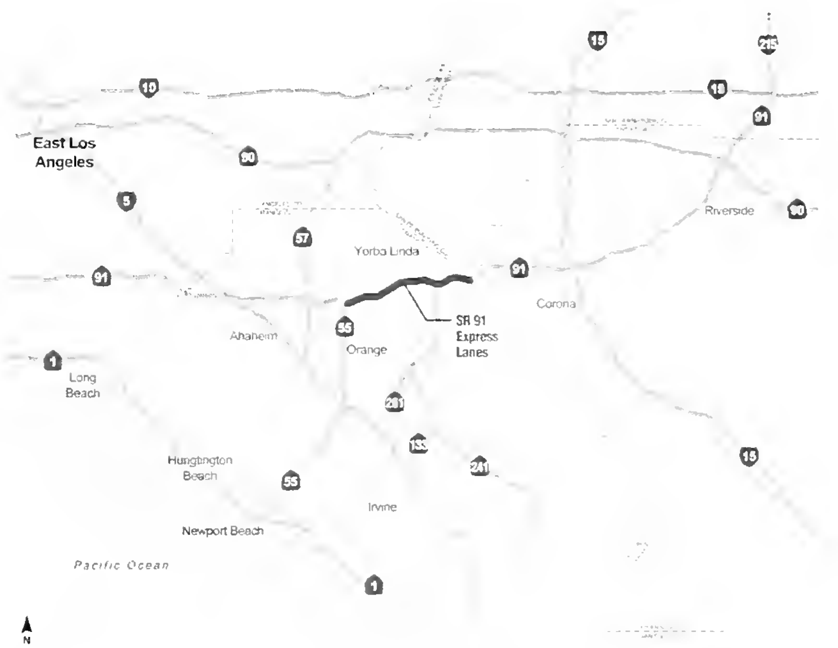

Figure 1. Map of State Route-91. *Source: A Guide for HOT Lane Development (Perez, 2003).*

Existing Projects	*SR-91*	*I-15*	*I-10 (Katy Highway)*	*US 290 (Northwest Freeway)*
Region	Orange County, CA	San Diego, CA	Houston, TX	Houston, TX
Authority	CalTrans	SANDAG	Houston Metro, TxDOT	Houston Metro, TxDOT
Number of Miles	10	8	13	13.5
Additional Lanes Built	4 new lanes	no	no	no
HOV Conversion	no	yes	yes	yes
Name of HOT Lane Project	ExpressLanes	FasTrak	QuickRide	QuickRide
Date HOT Lane Project Started	1995	1997	1998	2000
Design of HOT Lanes	2 HOT lanes in each direction, fully separated in the median; only one access point at each end: functions as a pipeline	1 HOT Lane in each direction	1 lane reversible flow facility, five access points	1 lane barrier separated reversible flow facility
Lane Capacity	1800veh/hour/lane		1500veh/hour/lane	6400veh/day
Tolling Structure	Discounted tolls for 3+ carpools, zero emissions vehicles, motorcycles, disabled, veterans	2+ carpools ride free, SOV pay toll	2+ carpools may pay to use the lane when the 3+ HOV is in effect, no SOV	3+ carpools ride free, 2+ pay toll
ATI	fully automated; must have FasTrak Transponder	fully automated; must have FasTrak Transponder	fully automated, Harris County Toll Road Authority QuickRide transponders	fully automated, Harris County Toll Road Authority QuickRide transponders
Cost of Project	$134 million; private toll venture, financed by CPTC	$7.96 million from FHWA Value Pricing Pilot Program		
Use of Proceeds	ROI to CPTC	transit service in the corridor (Inland Breeze peak-period express bus)		
Expansion Plans	n/a	extend I-15 HOT lanes, creating a 20 mile, reversible flow managed lane	possiblity of major expansion, HCTRA has offered $250 million to finance construction of Katy special use lanes	n/a

Table 1. Current value pricing roadway projects.

the result of a franchise agreement that was signed between CalTrans and the California Private Transportation Corporation (CPTC) in 1990 for construction, operation, and maintenance of two ten-mile toll lanes.

Demand for congestion relief in this corridor was so strong that the company announced the project had paid for itself by the end of its third year in 1998. In other words, toll revenues paid by drivers choosing to use the HOT lanes rather than the adjacent regular lanes are now high enough to cover the project's annual debt service as well as all operating and maintenance costs, with at least the beginnings of a profit to the company.

An extensive four-year study by CalTrans and the U.S. Department of Transportation (USDOT) evaluated the impacts of the variable-toll express lanes, exploring overall changes in traffic and travel behavior, vehicle occupancy, traveler demographics, alternative travel modes, operations and safety, and public opinions.

The resulting research shows that the express lanes provided an average time savings of nearly 13 minutes. Other perceived benefits include increased reliability, greater safety, and better predictability (Poole and Orski 2002). It was found that about 20 percent of commuters in each income category used the HOT lanes, suggesting that income is unrelated to whether persons changed their ridesharing behavior after the toll lanes opened. Those commuting to work are more likely to travel in the HOV lane than in the Single Occupancy Vehicle (SOV) lanes. Roughly 75 percent of HOV-3 work commuters report to be frequent toll lane users as compared to 26 percent and 16 percent, respectively, for non-work-related HOV-3 and SOV users (ARDFA, 1998).

The research also shows that there was no significant association between the opening of the managed lanes on SR-91 and changes in the HOV traffic on SR-57/60 freeway corridor 15 miles to the north. Thus, the toll lane exerted a local influence but did not affect traveler route shifts at the regional scale.

Interstate-15, San Diego, CA

In 1988, two underutilized HOV lanes were converted to reversible HOT lanes along I-15 in San Diego, CA, and overseen by a toll authority. The system consists of two reversible lanes constructed along an eight-mile stretch of I-15 (see Figure 2). The program was initially proposed by the San Diego Association of Governments (SANDAG). Nearly $8 million of Federal funding from the USDOT's Value Pricing Pilot Program was provided, matched by $2 million from the state to implement first a permit system on the lanes. The FasTrak Electronic Toll Collection (ETC) system was installed, which charged users of the HOT lane a per-trip toll based on congestion levels. Tolls range

Figure 2. Map of Interstate-15. *Source: A Guide for HOT Lane Development (Perez, 2003).*

between $0.50 during non-peak times and $8.00 during levels of severe congestion. Electronic signs placed in front of HOT lane entrances provide advance notice of the toll.

Daily traffic volumes on the express lanes averaged 18,500 vehicles in November 2001, a 102 percent increase from the pre-project level of 9,200, while still maintaining the desired high level of service. Under worst traffic conditions, FasTrak users save about 20 minutes of delay over the ten-mile corridor (DeCorla-Souza, 2002).

The typical HOT lane user was a middle-aged female of high income, highly educated, and from a household with two or more vehicles. An important feature of the I-15 lanes is that carpooling increased since the conversion of the HOV lanes, despite fears that the HOT option would discourage carpooling (Poole and Orski, 2002).

The project is self-sufficient, with the conversion requiring $1.85 million in capital costs (not including the transponders paid for by individual drivers), and is generating revenue at the rate of approximately $1 million per year.

Interstate-10 Katy Freeway and the US Route-290, Northwest Freeway, Houston, TX

In 1998, a 13-mile HOV lane along a central artery of western Houston was converted into a single, reversible HOT lane (see Figure 3). Designed to carry 79,200 vehicles per day, the Katy Freeway now carries over 207,000 vehicles per day, and it is considered one of the most congested stretches of freeway in Texas. Congestion may be present for 11 hours or more each day. Some estimates place the cost of the Katy's traffic delays to commuters, residents and businesses, at $85 million a year.

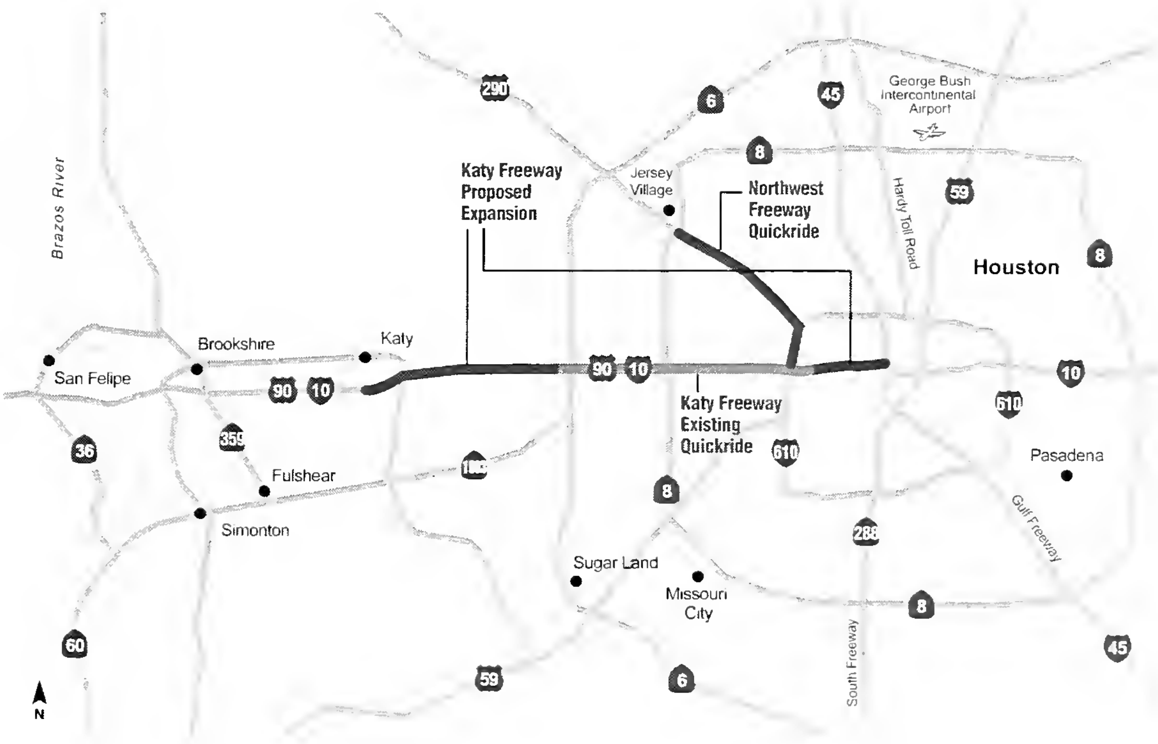

Figure 3. Map of Interstate-10 and U.S. Route-290. *Source: A Guide for HOT Lane Development (Perez, 2003).*

As currently configured, the Katy Freeway has three general-purpose lanes and two frontage-road lanes for most of its length in each direction. Situated in the center of the freeway is a barrier-separated High Occupancy Vehicle/Toll lane for carpools and buses, making a total of 11 through lanes. A single reversible lane, the HOT facility handles inbound traffic in the morning and outbound traffic in the evening.

When the Katy HOV lane first began operating, only buses and authorized vanpools were allowed to use it. The resulting underutilization gradually encouraged a loosening of the HOV entry rules: gradually, registered carpools of HOV-4, then HOV-3, then HOV-2 were allowed into the lane. (HOV-4, -3 and -2 refer to lanes requiring a minimum of four, three, and two passengers, respectively.) As restrictions were relaxed, traffic grew, and more restrictive carpool rules were eventually reinstated to HOV-3 at peak hours. With two-person carpools no longer allowed, the number of persons moved by the lane during peak hours declined 30 percent.

Most of the HOV lane users are commuters who formerly used the general-purpose lanes (Poole and Orski, 2002). Before and after studies of the Katy Freeway showed that its HOT lane application had the following positive results:

- The number of 3+ carpools increased during the peak;
- 2+ carpools redistributed to before and after the peak hour;
- Average traffic speeds increased and the HOV's level of service improved; and
- The same number of passengers was transported more efficiently.

While the evolution of the QuickRide system is a useful case study in itself, the number of paying users that these two facilities could accommodate is limited. Expansion plans for the Katy Freeway are currently under consideration and could significantly increase the scale and scope of HOT lane operations in the Katy Corridor.

The I-40 Project in North Carolina

In August of 2004, a team of researchers and engineers began investigating the feasibility of an HOT lane along I-40 in North Carolina. The research effort has been supported by funding from the North Carolina Department of Transportation (NCDOT) and the Federal Highway Administration (FHWA). The project team consisted of professors from NC A&T State University, UNC-Chapel Hill, and the director of the Piedmont Authority for Regional Transportation.

The team is researching the feasibility of a reversible, managed lane (eastbound in the morning and westbound in the evening) along I-40. The lane will be separated from the general-purpose lanes by candlestick markers. Drivers can use the lane for free if their car is HOV-3, or they can pay a toll. The toll will vary by the time of day so that there will be a higher toll during rush hour. The toll will be collected automatically so that there will be no tollbooths.

Figure 4 shows how the managed lane may appear once it is built. Figure 5 presents a map of where the managed lane is planned, between the I-40 Business and I-40 interchange, and where I-40 and I-85 merge.

Researchers are currently collecting survey data on the opinions of commuters living in close proximity to the proposed HOT lane. The researchers are also survey-

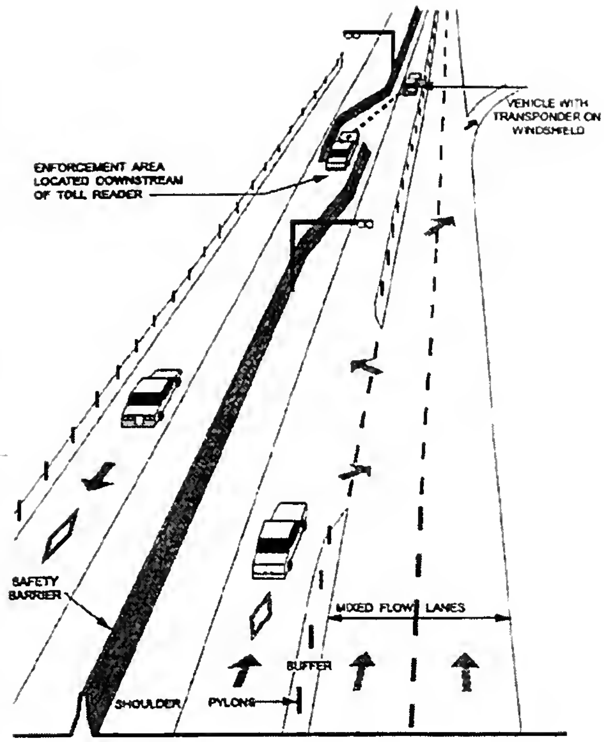

Figure 4. Sketch of possible design for HOT lane on I-40. *Source: Parsons Brinkerhoff, 1998.*

ing stakeholders in the project to determine their level of support for the project. The questions of both studies deal with the concept of using managed lanes for value pricing. This abstract approach was necessary because state legislation has not yet been adopted to support this form of tolling and enforcement. Suggestions for such legislation will be one outcome of the overall study.

Other Value Pricing Projects

The second stage of value pricing is underway either in the planning or implementation stage. Newly implemented projects include congestion tolls on Port Authority bridges and tunnels between New York and New Jersey and the Florida barrier island value pricing project. Value pricing lanes are also planned for Minnesota. Other plans have been investigated for Maryland. There are additional plans to expand the

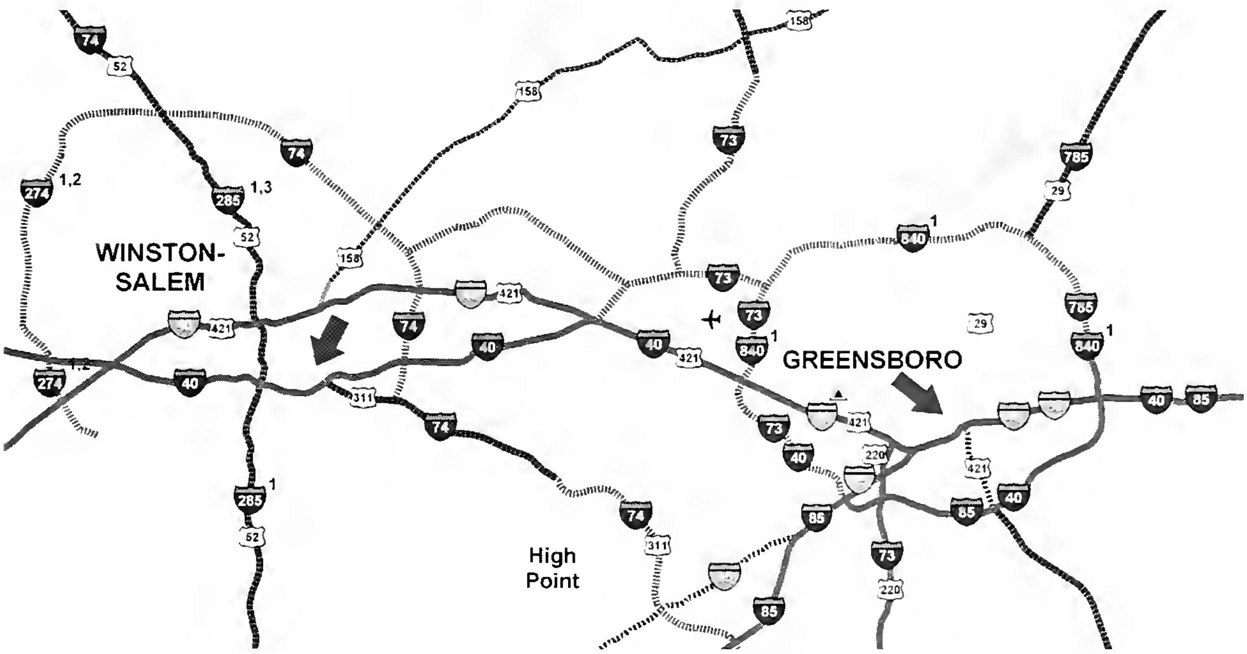

Figure 5. Location of possible HOT lane on I-40. *Image adapted from NCDOT Strategic Highway Corridor Map.*

existing small, eight-mile project to regional HOT lane networks. There have even been sketch plan proposals for HOT lane systems in the twenty largest American cities.

Concluding Remarks

In recent years, value pricing has become a frequently used element of design in areas of the United States that experience congestion, as it promises to encourage ride-sharing and higher occupancy rates while providing drivers the option of avoiding traffic bottlenecks.

Acknowledgement

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A Business Case for Southeast High-Speed Rail

Terry Chastain

Abstract

As the Southeastern region of the United States continues to experience increasing levels of congestion on the regional highways, the Southeast High-Speed Rail corridor presents an appealing alternative to automobile travel. The corridor is slated to run from Washington, D.C. to Charlotte, North Carolina and eventually from Charlotte to Birmingham, Alabama. The key to implementing the project is the privatization of operations, a model not traditionally used for rail in the U.S. With the Southeastern states moving ahead with the environmental impact statements, the outstanding issues include setting the timeline, choosing the operators, and designing the routes.

Introduction

With tremendous economic and population growth, the Southeast needs a comprehensive, multimodal transportation system. High-speed rail (HSR) service will provide business and leisure travelers with a competitive alternative to air and auto for trips between 100 and 500 miles.

The Southeast High-Speed Rail Corridor (SEHSR) is one of five originally proposed high-speed passenger rail corridors designated by the U.S. Department of Transportation (USDOT) in 1992. The corridor was designated to run from Washington, D.C. through Richmond, VA and ending in Charlotte, NC. It is part of an overall plan to extend service from the existing (ACELA, or Amtrak) high-speed rail on the Northeast Corridor (Boston to Washington) to points in the Southeast (see Figure 1).

High-speed rail in the Southeast will mean a top speed of 110 mph and average speeds between 85 to 87 mph. Virginia, North Carolina, South Carolina, and Georgia have joined together with the business communities in each state to form a four-state coalition to plan, develop and implement high-speed rail in the Southeast. Under the current plan, the system will be developed incrementally, upgrading existing rail rights-of-way. Portions of the Washington–Charlotte SEHSR corridor could be completed by 2010, depending on funding availability.

The Need for High-Speed Rail

A regional approach to transportation will help states in the Southeastern region to meet the challenges of

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growth, while improving air quality. The highways of the region and the airports along the Eastern seaboard simply cannot handle the present traffic volumes, let alone accommodate future travel needs. The South has the highest per capita vehicle miles traveled [1] and ranks second in carbon monoxide emissions (USDOT, 2001). Recent figures from the USDOT reveal the growing transportation needs of the Southeastern states. As implied in Figure 2, traffic congestion on urban freeways in the Southeastern region is expected to increase by 400 percent by 2020 (Southeast High-Speed Rail, 2003).

centers. Refurbished and expanded stations could be transformed into mixed-use facilities, and SEHSR could also encourage significant public/private investments.

Compared to air travel under three hundred miles, HSR has many advantages. First, most airports are located miles away from city centers, whereas HSR could connect directly to downtown areas. Second, a business traveler could make use of electronic equipment (cell phones, laptops, etc.) the entire trip, thus providing an opportunity for increased

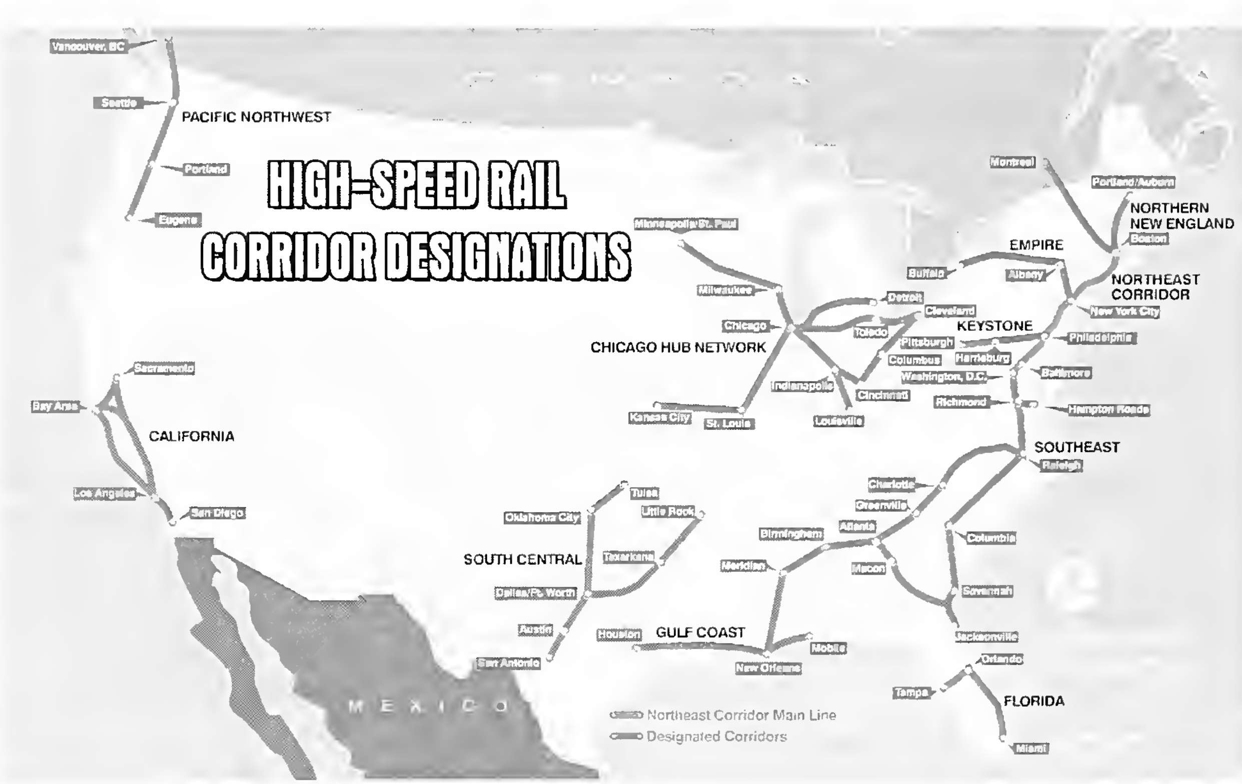

Figure 1. High-speed rail corridor destinations. *Image courtesy of Terry Chastain.*

Meanwhile, $4.5 billion must be spent on roads to accommodate existing levels of congestion.

From an economic development perspective, SEHSR could facilitate urban revitalization by bringing more travelers directly to downtown

productivity. Third, HSR could arguably be less stressful than the air experience given today's current security situation.

As congestion continues to increase along major interstate corridors, HSR travel times will also

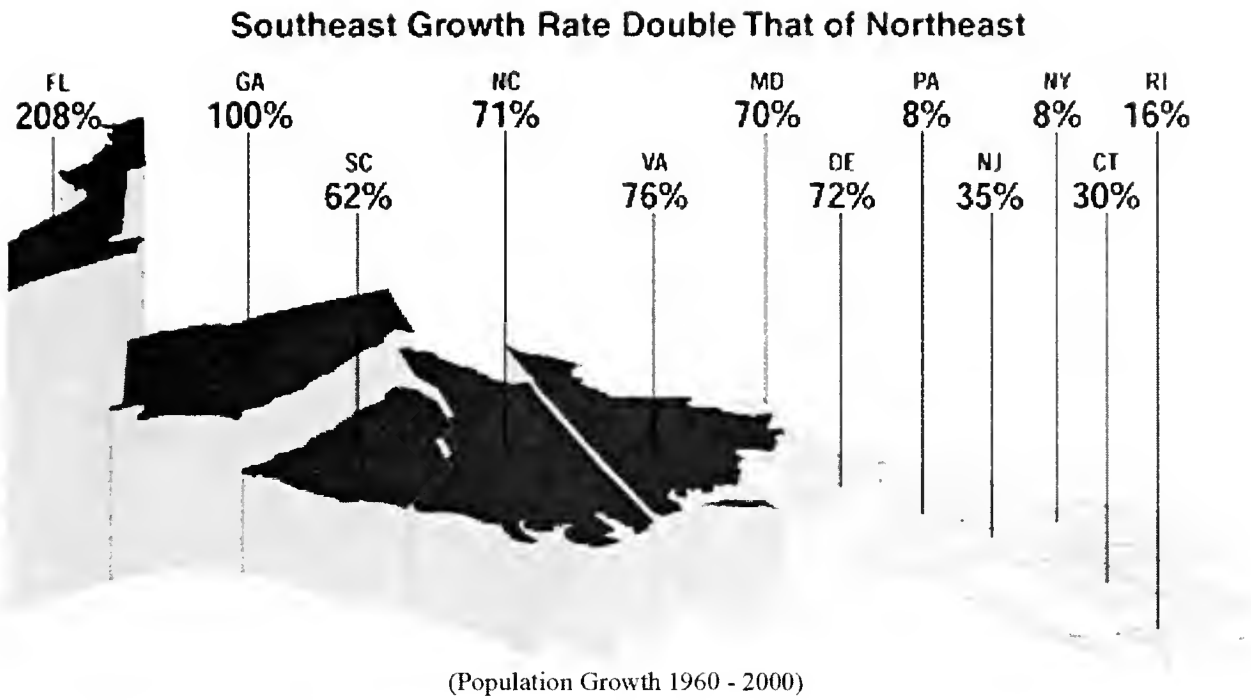

Figure 2. Southeast growth rates and implications for traffic congestion. *Image courtesy of Terry Chastain.*

continue to improve in comparison to driving times. The intercity business traveler choosing the auto for transportation will often have to compensate for the unpredictable nature of interstate congestion due to accidents, construction, or volume by leaving earlier than otherwise necessary.

High-speed rail will allow for time-efficient travel between cities in the Southeast (see Figure 3). Assuming only an average speed of 75 mph and a 45 minute check in allowance, HSR from Richmond to Washington would be a little over two hours; four and a half hours from Raleigh to Washington; three hours from Charlotte to Raleigh; four hours from Atlanta to Charlotte; two hours and forty-five minutes from Atlanta to Greenville; and two hours and forty-five minutes from Birmingham to Atlanta (see Figure 3).

A New Business Model for High-Speed Rail

This new model calls for the privatization of operations, user, and market driven route planning, and changes in funding, with a focus on rapid service to major population and financial centers with a minimum of stops. [2]

Currently, Amtrak operates all passenger rail service in the Southeast. Amtrak, known officially as the National Railroad Passenger Corporation, began service in 1971. Its route map and budget are subject to Congressional oversight and appropriations, which could be described as too little to allow success and too much to force insolvency. Few routes turn an operating profit, and in fact most routes operate in the red to a shocking degree. SEHSR, however, will benefit from competition because privatization allows the operator to choose

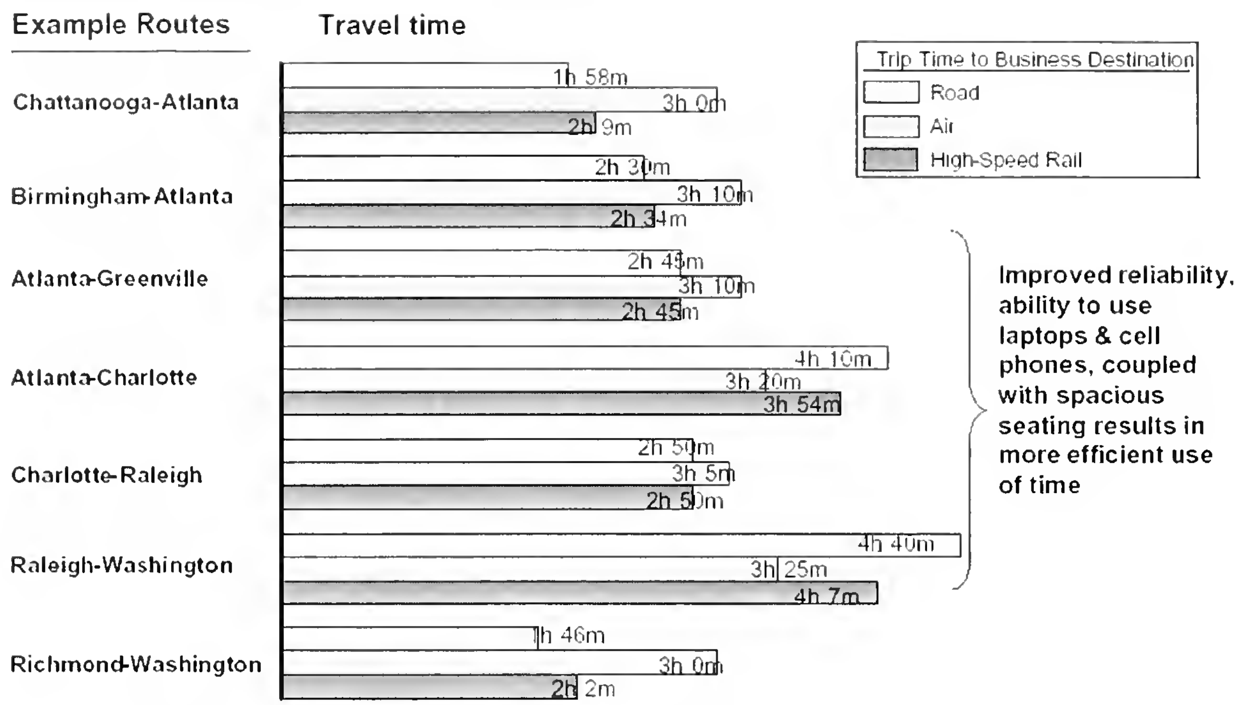

Figure 3. Travel savings for high-speed rail users. *Image courtesy of Terry Chastain.*

the profitable routes and stops rather than have the government choose them.

The Alliance's model proposes that the operator choose the routes and stops, which will be dictated by demand. As opposed to the current system, the operator will not be forced to run on unprofitable routes or make stops which are counter-productive. Also, the targeted riders of the Alliance's model are time-sensitive to business persons and short-haul leisure travelers.

Finally, the Alliance's model calls for a change in funding. Under the SEHSR proposal, the Federal government will make the initial investment in infrastructure for SEHSR, while operational costs will be maintained by the operator.

Cost

The Alliance's model estimates that total construction of the first phase of SEHSR, from Washington, D.C. to Birmingham, would cost approximately \$5.5 billion dollars. Initial studies indicate tickets will cost about 20-22 cents per mile (based on calculated demand for the service). This compares to air travel at 22-75 cents per mile and auto travel at 30-35 cents per mile.

The U.S. Department of Transportation, in reviewing the high-speed rail plans for 23 states, came to the conclusion that the SEHSR route will produce more revenue than any other proposed corridor. It is estimated that it will generate \$2.54 in public benefits for each dollar spent to build and operate the corridor. SEHSR is the only proposed corridor projected to cover its total operational costs from the fare box.

Growing Support for High-Speed Rail in the Southeast

Numerous studies conducted to date reveal the benefits of a high-speed rail service in the Southeast. According to a USDOT study, High-Speed Ground Transportation for America [3], the Southeast is the best investment for new high-speed rail service. The report concluded that, as an extension of the Northeast Corridor, SEHSR operated at a top speed of 110 mph will "generate more revenue than any other" proposed expansion. The ratio of public benefits to public costs is 27 times greater than any other corridor. The average trip would be longer and generate more revenue than any other route. SEHSR will also provide economic benefits both to Southeast states and the Northeast Corridor since it "would increase traffic levels on the Northeast Corridor itself…thus creating synergistic ridership, revenue, expense, and income effects" for both regions.

North Carolina has completed an extensive economic development study on the impact of the construction and operation of SEHSR (Southeast High-Speed Rail Cooridor, 1999). The project is expected to generate $700 million in new taxes; approximately $10.5 billion in employee wages over 20 years; over 31,000 new one-year jobs from construction; over 800 permanent railroad operating positions; and nearly 19,000 permanent full-time jobs from businesses which choose to locate or expand in the state as a result of SEHSR.

In addition, North Carolina, Georgia, and South Carolina have recently completed a HSR feasibility study from Macon to Charlotte, via Atlanta, Greenville, and Spartanburg. The report concluded that HSR trains are feasible in the corridor. Now, the states are in negotiations with Norfolk Southern – the railroad company that owns the line – for a detailed capacity study to see how implementation of SEHSR would impact the company's freight business. Following that, the states are committed to beginning work on a Tier I Environmental Impact Statement (EIS) along the route.

Key Advances

Figure 4. Existing Rail Station in Ashland, VA. *Source: Time to Act (Southeast High-Speed Rail Cooridor, 2003).*

Virginia is making great strides to extend SEHSR from Washington to Richmond (see Figure 4). A total of $210 million in funds have been committed for infrastructure improvements along the line. Agreement has been reached with the railroads and a timetable for construction has been set. The City of Richmond has recently completed a $50 million renovation and conversion of the Main Street Station into a multimodal facility in anticipation of service in the near future.

For $71 million, North Carolina purchased the North Carolina Railroad, which owns the Raleigh to Charlotte section of SEHSR. The state is also in negotiations with CSX to purchase the railroad line from Raleigh to the Virginia border. North Carolina has also spent close to $100 million of state and Federal funds to refurbish and reconstruct rail stations.

In 2000, North Carolina and Virginia prepared a Tier I EIS, examined the need for the project, and looked at potential impacts on both natural and built environments along nine possible routes. Public involvement was critical during this phase with 26 public information workshops and 18 public hearings that solicited feedback about the project. Citizens, political leaders, planners, resource agencies, railroad officials, and other interested parties were among the many participants of the workshops and hearings.

The Final EIS, which outlines why the recommended alternative was selected, was completed in June 2002 and a formal Record of Decision was issued in October 2002. This Federal document confirms and approves the corridor recommendation by the Tier I EIS. Virginia and North Carolina are now proceeding with the next phase, Tier II, which provides a detailed analysis on the impacts, including track location, station arrangement, and detailed design. Rather than a single large document, smaller Tier II environmental studies will be conducted for specific segments of the route where track work will be needed. The document should be available for public review in early 2005. At that time, public hearings will be held along the affected corridor. In 2005, the final Tier II EIS is expected to be completed and the Record of Decision obtained for the Petersburg to Raleigh segment. Right-of-way and permit acquisition can begin at that time.

The Washington, D.C. to Charlotte portion of the SEHSR corridor could be implemented by 2010, depending upon funding availability. In the meantime, other projects will reduce travel time within the next few years. Implementation of the remainder of the SEHSR into South Carolina, Georgia and Florida will follow by several years. [4]

Conclusion

Leaders in North Carolina and Virginia have committed a great deal of political and financial capital into laying the foundation for the future of SEHSR. Georgia, South Carolina, and Alabama are themselves becoming convinced that the SEHSR will be operational at least from Washington to Charlotte in the foreseeable future and have thus began preparations for future extensions from Charlotte to Birmingham (see Figure 5).

Figure 5. Possible route for high-speed rail line across the Southeast. *Image courtesy of Terry Chastain.*

The eventual completion of the SEHSR corridor is inevitable due to the commercial viability of the trains themselves, the region's continued population growth and environmental challenges. The main questions that remain are: when will it be built; who will operate it; and where will the routes and stops be located?

About the Alliance

Formed in 2000, the Southeastern Economic Alliance (Alliance) is a coalition of 15 chambers of commerce from 6 states: Atlanta, Birmingham, Charlotte, Charleston, Chattanooga, Columbia, Greensboro, Greenville, Hampton Roads, Macon, Raleigh, Richmond, Savannah, Spartanburg, and Winston-Salem. The Alliance recognizes that implementation of the Southeast High-Speed Rail (SEHSR) corridor would efficiently link business centers in order for the Southeast to compete in global and regional economic markets. The Alliance does not select routes, are not rail technical experts, and is not linked to Amtrak.

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Endnotes

1. Regional miles per capita: South—11,057; Midwest—9,812; West—9,806, Northeast—8,218. Source: from website http://www.southeastalliance.com/files/businesscase2-28-03.pdf

2. For more detail on the business model, see www.southeastalliance.com.

3. For a copy of the report, see: http://www.fra.dot.gov/us/content/515. This study focused on the Washington to Charlotte leg, because Charlotte to Birmingham has yet to be designated a HSR corridor.

4. For a more detail chronology, see http://www.sehsr.org/history.html.

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Mass Evacuation and Our Nation's Highways

Gregory B. Saarthoff, M.D. & John B. Noftsinger, Jr., Ed.D.

Abstract

Americans use the interstate highway system as a means of escape from natural disasters, but these roads may offer false hope with regard to escaping terrorist attacks. Such disasters require a different and creative approach to prevent chaos and the overuse of the highway system in evacuating metropolitan regions which could potentially lead to other harmful consequences.

Marshalling Eisenhower

Although not as glamorous as battlefield heroics, visionary logistical planning is often the key to victory. Just as it is crucial in conventional warfare, this leadership attribute will determine the success or failure of public preparedness and response in the current climate of war and terrorism.

Two important Americans, George Marshall and Dwight Eisenhower, provide illustrative examples. During World War I, then-Lt.Col. Marshall identified nodes of transportation and communication along the route to the Argonne in order to very quickly relay 660,000 troops and their supplies (Goldhurst, 1977). Marshall understood the possibilities of the transportation infrastructure, and he used logistical planning to assure major Allied victories in France. His evaluation of roadway capacity, during a critical time and amid unprecedented events, showed that victory on the battlefield could be achieved largely through preparation and planning.

Dwight Eisenhower's travels over rough roads as a young officer, and his later experience with the German autobahn during World War II, led him as President to support the development of an interstate highway system in the 1950s. The highway system was initially developed with defense purposes in mind. Eisenhower envisioned a modern network of highways across the continental U.S. that could serve civilians during peacetime but

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could also accommodate aircraft on strategic runways and transport troops between strategic outposts in times of war.

Figure 1. Congestion on highways from evacuators fleeing a terrorist arrack could put even more of the population at risk. *Photo by Erik Malkemus.*

The expansive U.S. highway system may at first glance seem to be a very appropriate mechanism for evacuation and self-preservation in the event of a terrorist attack. However, while a mass movement of troops in World War I solved a great problem for George Marshall, massive movement of civilians in the current war on terror is not so much a solution as a potential risk. It may be that the most valuable transport after a weapon of mass destruction (WMD) attack will be the delivery of necessary provisions and services to communities in order to enhance their resilience and ability to remain intact.

The Role of the U.S. Highway System

For better or worse, our highway system has stood as a model for the world, sparking a cloning of similar transportation networks in industrialized and developing countries alike. As the greatest transportation infrastructure project ever tackled by the Federal government, our vast, maintained, and seamless interstate highway system is a testament to Eisenhower's vision half a century ago. However, a closer look reveals cracks in the pavement. Extensive usage by commuters and commercial vehicles has caused our interstates to be overcrowded and dangerous (see Figure 1). Furthermore, much of the current interstate system in the United States is rather archaic, since it does not yet fully integrate car and driver with the road by using the latest information technology such as Intelligent Transportation Systems (ITS). ITS refers to the confluence of information technology and transportation systems. Intelligent Transportation Systems have been heralded as the solution to many of our current and future transportation challenges. For example, Smart Roads, as they are often called, can boast video cameras, sensors, and the latest wireless communication systems. However, entrenched state highway departments, incompatible standards, insufficient regional cooperation, immature technology, and large costs have limited the application of ITS. Although funding has increased for pilot projects and research involving Smart Roads, their greatest benefits do not yet directly accrue towards homeland security.

While no longer the most modern or safe, our system of highways and interstates is still looked upon as a

secure place to ensure a "fast getaway." It is this feature, in fact, that may attract anxious citizens to rush to the roads in mass evacuations in the event that our cities are attacked with weapons of mass destruction.

Evacuation as Solution

According to the dictionary, the definition of "evacuation" is the "organized, phased, and supervised dispersal of people from dangerous or potentially dangerous areas" (Glossary of Disaster Management, no date). The concept of evacuation may seem simple, but in the context of national security, it is an umbrella term encompassing various procedures and detailed planning. Ideally, an evacuation order would constitute a responsible directive that leadership provides to a population facing grave danger within its community. This type of evacuation can be voluntary or mandatory, depending on the seriousness of the threat. In other words, when other alternatives are not safer, a responsible leader directs a responsive population to depart from the current location in order to move to a safer specified location.

Knowing Eisenhower's keen appreciation of the dual needs of citizens and the military in times of war, this concept of targeted evacuation is consistent with his vision. Citizens would benefit from the orderly departure from an area of greater danger to an area of less danger, while the military would be able to utilize the highway system in order to protect national security. This has often proven to be the case during natural disasters. However, past successes with evacuation for natural disasters may provide a false sense of security in the use of the highway during future unnatural disasters.

Evacuation during Natural Disasters

Over the past five decades, government leaders have improved upon their ability to communicate with the public in a way to target evacuation for specific populations that are otherwise subject to grave dangers posed by floods, fires, and the like. Although natural disasters are often dramatic events, citizens most often respond in logical, rational ways, and they will not only make rational choices for themselves, but will often assist fellow citizens in collaborative and even altruistic ways. Research demonstrates that panic in *natural* disasters is extremely rare. This, in part, may be due to the amount of time people have to prepare themselves for an evacuation. Often, the threat of a natural disaster (such as a hurricane) is picked up in advance and information is dispersed in a timely manner (Peek, 2003). Even in the case of earthquakes, where there is no warning, structural engineering has evolved to mitigate some of the havok that serious quakes can unleash. While valuable in understanding known threats, this research tells us little about our response to threats that are unnatural and occur with little or no advance notice.

Shadow Evacuation during Unnatural Disasters

Thankfully, the world's experiences with unnatural disasters involving radiation, chemical, and biological weapons are extremely limited up to this point in time. However, a review of unnatural disasters at home and abroad belies less cause to be sanguine about expected public responses. We do know that in the Three Mile Island nuclear reactor incident, unnecessary evacuation—known as shadow evacuation—occurred. In this instance, individuals who were outside of the perimeter of

contamination also chose to evacuate, thereby clogging the transportation arteries at a time when they were most needed by those who were within the contaminated area. During a 1997 chemical spill in West Helena, Arkansas, although 90 percent of those who were told to evacuate did so, an additional 32 percent chose to evacuate after they were instructed to shelter in place (Oak Ridge, 2002). This converse of evacuation, sheltering in place, consists of "selecting an interior room or rooms within your facility, or ones with no or few windows, and taking refuge there. In many cases, local authorities will issue advice to shelter in place via TV or radio" (U.S. Department of Labor, 2005).

Spontaneous Evacuation

Targeted evacuation has an evil twin that has rarely surfaced in our experience with natural or even unnatural disasters. Known as spontaneous evacuation, it is the stuff of dramatic action films. Complete with ineffectual government officials and hysterical citizens, the scene of spontaneous evacuation is a true goal of terrorists, since it represents societal entropy: a chaotic situation that impacts the economy, the inability for government to adequately access its existing infrastructure, and ultimately, the public's disconnection from government. Spontaneous evacuation occurs when "residents or citizens in the threatened areas observe an emergency event or receive unofficial word of an actual or perceived threat and without receiving instructions to do so, elect to evacuate the area. Their movement means, and direction of travel, is unorganized and unsupervised" (Glossary of Disaster Management, no date). A spontaneous evacuation can be ultimately deleterious to the government's goal of protecting citizens and transporting victims in need of healthcare. Therefore, government plans for evacuation after a natural disaster may not prove effective in the case of a terrorist attack.

Planning for Unnatural Disasters

How can communities prepare for unnatural disasters? The issues of public response involve complex logistics. The key to a safe and successful public response is preparation. Without prior planning, we may provide an all too anticipated response to an attack.

Surge Capacity and Surge Suppression

In order to appreciate our infrastructure's vulnerability, we can look to the capacity of metropolitan highways. Surge capacity is traditionally a medical concept which refers to the point at which caring for patients overstresses the health care system's ability to comfortably provide patient care. Just as we speak about surge capacity in terms of health care and its ability to meet peak needs, we can apply issues of surge to our transportation system. The traditional view of surge capacity that looks only at static resources, such as hospital beds, is not sufficient in planning for potential terrorist events. A modern understanding of surge capacity requires us to look at resource availability in a dynamic, interdependent way. In the flow of a crisis, it is important to understand not only the issue of surge capacity but also the issues of surge suppression. For the purpose of this article, the concept of surge suppression (a term borrowed from electronics), refers to the means to prevent damage or overload to critical infrastructure during transient spikes in usage. Surge suppression is a

complementary concept central to a more complete understanding of surge capacity. A thoughtful understanding of both surge capacity and suppression appreciates the dynamic interplay between physical, psychological, and social elements of critical infrastructure.

Critical infrastructure, whether referring to highways or hospitals, is often geographically based, tied to existing population density and predicated upon the ability of human resources to operate, maintain, and repair various aspects of that infrastructure during times of crisis.

In the event of terrorist attack, our critical infrastructure will be threatened if individuals choose to flee their communities rather than to remain. The stakes are enormous. If population density shifts through unplanned, spontaneous evacuation, population surges will create overloading spikes in resource utilization in areas that are ill equipped to handle the resultant stresses.

Community Shielding

During the past two years, the Critical Incident Analysis Group (CIAG) has developed a concept called "community shielding" that has broad policy implications for public response to weapons of mass destruction attacks. This concept entails a pre-planned, community-wide, shelter-in-place response, with an emphasis on communication and delivery of essential services to affected populations.

In the event of a terrorist attack, individual and community responses will be the most important predictors of survival. Although there can be a natural inclination to flee from a disaster, in most cases the wisest choice for survival will be to stay within one's own home or work community. The choice is complicated by the very success of our interstate highway system. Serving as a seductive route for evacuation, it can result in a static gridlock during a spontaneous evacuation, leaving citizens trapped and vulnerable in vehicles.

The decision to preserve our options by remaining in our home communities is known as community shielding, and it can serve to support our individual and community needs. By preparing community shielding plans, we may be able better match those in the area who need assistance with those best able to provide it. Community shielding is a means for the public to shelter in place and, if necessary, be supported in that status through the delivery of essential items. We know that coping with crisis is easier when we are in a stable environment. Knowing where we will sleep, eat, and receive information is comforting and beneficial, and these survival functions take on greater significance during a crisis (Saathoff, 2002). Better than any medication that we know, information treats anxiety during a crisis. When that information is trusted and from a local source, it is more likely that it will be specific to the needs of our community. When citizens are able to safely support their neighbors while engaging in community shielding, the needs of those Americans who are truly needy due to homelessness or isolation can be much more effectively addressed by targeted government, medical, faith-based, and other private sector services (Stein, in press).

Since each community is unique in its strengths and vulnerabilities, proactive planning for effective community shielding is necessary on a community-by-community basis. Service organizations such as

Citizens' Corps can facilitate this type of planning. Distribution and dissemination of Department of Homeland Security (DHS) and community specific information can be distributed through public sector channels (like schools) and private sector channels such as local shopping centers.

Implications for North Carolina

The Tar Heel State is not as far removed from these scenarios as one might think. Major U.S. Army and U.S. Marine Corps installations reside in Eastern Carolina, and their emergency mobilization would occupy Interstates 95 and 40. Regarding Interstates 85 and 95, should an evacuation surge southwards from Washington D.C., North Carolina could feel its effects, particularly if the medical capabilities of the Triangle were in demand. Also, Charlotte is the nation's number-two financial center, following New York, whose financial prowess already has been a victimized target. While North Carolina may not be considered an obvious target for terrorist attacks, each state and local community should consider developing planning strategies to deal with the effects of unnatural disasters and the spontaneous evacuations that could arise in the wake of these events.

The Role of Leadership

Leadership, top-down planning, and local-level planning are all essential for the development of adequate surge capacity within our critical infrastructure, whether it be related to transportation or healthcare. While this central aspect of Federal planning is vital, the physical, psychological, and social value of decentralization must not be overlooked. "Centralization of functions and decision-making in the national government may also be poor counter-terrorism policies. Populations are better protected by redundancy than by centralization, since redundancy permits most units to continue functioning even after some are damaged or destroyed" (Terwillinger, 2003).

This redundancy is perhaps best represented by individual households, neighborhoods, and communities. As Barkun has described in his report entitled "Community Shielding and the Political System," the multiple layers of the shielding model consist of households, local communities, states and the Federal government. This complementary "bottom-up" strategy recognizes that households are the fundamental units in the event of a terrorist attack. The household's ability to manage the lives of its members is critical, and its success constitutes the "surge suppression" previously described. The next higher level of government, social, and medical resources should not be utilized during a crisis unless absolutely necessary (Barkun, 2002).

The Department of Homeland Security has made a commitment to partnering with stakeholders in public preparedness. Through development of homeland security strategies, the Department demonstrates an appreciation of the dynamic that exists between first responders, the government, and citizens. When cultivated, this enhances the development of effective grass roots tactics required by individual communities. To the extent that communities play the lead role in developing these plans, they will also own them.

Conclusion

What can we learn from past wars? In order to accomplish his miraculous transport of troops to the Argonne in 1918, Lt.Col. George Marshall relied on the concept of redundancy and the delegation of leadership. To accomplish his mission, he supplied the vision and strategic plan and relied on officers posted in the field. Marshall credited the mission's success to the one thousand officers posted at strategic points along the routes. These officers demonstrated remarkable leadership in accomplishing the logistical feat of transporting more than a half million troops under dangerous conditions in record time.

The Department of Homeland Security continues to develop partnerships with community leaders who are placed strategically within vulnerable metropolitan areas. Their actions will be the determining factor in the preparation and response of citizens who suffer a terrorist attack from weapons of mass destruction. The promise of the distant future may reside in smart technology for highways and transportation systems. However, the demands of the present require that community leaders develop meaningful alternatives to evacuation such as community shielding, so that citizens can receive the support that they require in order to effectively shelter in place.

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Planner Profile: Janet D'Ignazio

This issue's Planner Profile features Janet D'Ignazio, Senior Research Associate at the Center for Transportation and the Environment (CTE) based at North Carolina State University. Janet has 27 years of experience in the planning field, beginning with her first job after graduate school as the first transportation planner for the Town of Chapel Hill.

CPJ: We understand that you began your transportation career with the Town of Chapel Hill and that you have been back in North Carolina now for six years. Tell us about the "in between years."

JD: After working for the Town of Chapel Hill, I worked on a grant that sought to set up ride-sharing programs throughout North Carolina. My next stop was Roanoke, Virginia where I ran the transit system as the Assistant General Manager. My main responsibilities included planning, contracts, and financials. I then held a similar position in Birmingham, AL and then again in Chapel Hill.

In each of these positions, I always attempted to integrate other programs with transit. For example, in Roanoke I worked on a ride-share and transit program, which made use of downtown parking garages. We arranged for shuttles for various events that transported people from the garages to the event site. In Birmingham, as a means of broadening the economic development strategy, we designed transit services to serve the racetrack.

CPJ: Which of these job positions or locations did you enjoy the most?

JD: Looking back, both of my experiences in Chapel Hill stand out as my best jobs. I think that is because Chapel Hill provides a unique environment with a university that enabled opportunities to implement transit items that I usually could not elsewhere: bike, pedestrian, and bus programs. As I moved from one transit position to another, I began to see the pieces of my career puzzle fitting together; I was moving from specializing to integrating. This change was career-shaping for me, as it led to my next position as the Assistant Secretary to the Director of Transportation at the Michigan Department of Transportation (DOT).

CPJ: How did your Michigan planning experience fit into that puzzle?

JD: Michigan has one of largest public transportation programs in country. For example, when I was there we were working with a $200 million budget. I was able to work on many aspects of transit, including bus, rail (passenger and freight), and a ferry which supports the bus system. Again I was able to practice integration of modes and take a broad-based approach to transportation.

Planner Janet D'Ignazio has worked across the nation , contributing to the planning field for 27 years. *Photo courtesy of Janet D'Ignazio.*

At the time, Michigan DOT was in a process of self-examination. They were approaching operations from a new angle: that of a strategic business plan for DOT. This prompted the department to ask questions like, "what kinds of changes need to occur?" and "what skill sets do we need?" It was a private sector approach to a government agency and a great application of planning skills.

My time at Michigan DOT was career shaping in a new way: it was the beginning of my interest in organizational change. I believed, and still do, that government can and should be better than it is. It was this realization that helped me choose to stay in the public sector because I saw that that is where transportation planning needs to happen. Michigan was an ideal place for me to begin my quest for how to make government work better because it was a transforming system from all sides—data, process, and structure.

And this brings me back to North Carolina. My work at Michigan DOT led me to become involved in "process work" and this is what I focus on now at the Center for Transportation and the Environment. I see this as bringing together all of the pieces of my previous work experiences. I see my primary charge as "how can we make planning in North Carolina work better and how can it be more important than it has been in past?"

CPJ: What aspect do you find most satisfying about your work?

JD: I have the opportunity to design a planning process for North Carolina that is state of the industry. For example, bringing an environmental stewardship ethic to NCDOT requires a cultural change. But by doing so, we are working to make NCDOT as effective and efficient as it can be. And this is a true application of long-range planning that is taught in a planning program.

For all 27 years of my career, I have been lucky to have challenging and interesting work, and, perhaps most significantly, I feel I have made a difference. To me, that is what job satisfaction is all about.

CPJ: You are working on a number of innovative projects at CTE. What project are you most excited about?

JD: Definitely the NCDOT project focusing on streamlining the planning process. It is very conceptual, but it is basically the ability for long-range trans-

portation planning and the intended product to connect. Typically, long-range plans (LRP) end up on some shelf. What we are doing at CTE is finding a way to connect long-range planning and the National Environmental Policy Act (NEPA) process. As these two processes function now, there is a lot of wasted time. Therefore, there is a critical need to figure out how to combine the two processes so that NEPA can pick up where the LRP left off. Now, the LRP becomes relevant and makes projects better because what is evaluated and what is implemented are in line. I see this as a way to integrate what is important to the community; it comes out in the LRP, but traditionally it does not filter to the implementation process.

It is by no means an easy change and right now everything seems possible. Yet, if NCDOT can implement only half of what they are working on, things will be so much better.

CPJ: Do you have a vision for the future of transportation in North Carolina?

JD: Let me preface my answer by acknowledging that North Carolina is growing fast, and that it is also a State that places a high value on its natural beauty and environment. My vision is something like this:

It is critical to look at transportation issues from a mobility perspective, not a moving car perspective, and the State is moving in that direction. So I see the State as being very multimodal: being a midpoint for a high-speed train from D.C. to Atlanta; including modern public transit systems in all of the large cities; having regional connectivity by rail or High Occupancy Vehicle (HOV) lanes; building a system that will emphasize aesthetics to make transportation a process that is seamless with the natural beauty of the State; greater integration of freight movement—rail, highway, aviation, ports. An ideal world of transportation is attainable in North Carolina. Policy makers recognize that the State needs to be economically competitive and provide the quality of life North Carolinians want. It's not an easy road, but it is possible.

CPJ: How do you envision the future of your career?

JD: Opportunity will drive the direction my career, as it always has. However, my dream opportunity would be to serve as a Secretary of a State DOT, to be the second-in-command. In this capacity, I could implement the organizational changes that I am working on now. But such an opportunity would be a chance thing.

I will more likely stay in the academic world (like my current position with CTE) or I will do consulting with the right kind of firm. For me, the key word is integration: modes, systems, economic development, environment, and land use.

News Briefs: Regional Planning and Awards

TTA Rail Project

The Triangle Transit Authority is a regional public transportation authority serving Durham, Orange and Wake Counties. The agency is currently planning for the development of a Regional Rail system, which will be supported by shuttle and local bus service. Construction of the rail line should begin in early 2005.

This service, planned to be operational by 2007, would use self-propelled, bi-directional, diesel rail cars using the existing railroad rights-of-way to connect Durham, Research Triangle Park (RTP), Cary, Raleigh, and North Raleigh. The costs for construction are approximately $724 million (2002 dollars). This service is expected to carry about 28,000 daily riders by 2025.

Shuttle or feeder bus systems are being planned to connect people to future rail stations. Existing local bus services will also be coordinated to serve the rail stations.

EPA National Awards for Smart Growth

The Environmental Protection Agency (EPA) announced in November of 2004 the five winners of the 2004 National Awards for Smart Growth Achievement at the National Building Museum in Washington, D.C. The Award recognizes outstanding achievement in Smart Growth by governments of localities, regions, or tribes in five categories: Overall Excellence, Built Projects, Policies and Regulation, Community Outreach and Education, and Small Communities.

This year, planning departments in North Carolina received two of the five awards granted.

Overall Excellence in Smart Growth: The Town of Davidson Planning Department, North Carolina

The small community of Davidson, North Carolina—located just 20 miles from Charlotte—has succeeded in building vibrant neighborhoods while maintaining its historic heritage. In recent years, the town has been working to revitalize existing buildings and build new neighborhoods that incorporate a variety of lot sizes and housing types, affordable housing, and parks in a walkable environment.

In an effort to preserve Davidson's small town character, the town adopted the Davidson Land Plan in 1995 and an innovative Planning Ordinance in 2001. The ordinance calls for significant public involvement, including charrettes for each new development project. The town's ordinance also requires pedestrian, bicycle, and street circulation plans for all new development. Traffic calming devices, including

narrow, tree-lined streets that are equipped with sidewalks and feature on-street parking that discourages cars from speeding, ensure that town residents have a safe place to walk or ride bikes. In addition, the town requires that developers ensure that 12.5 percent of all new housing built is affordable to families making less than the county's median family income. Recently, the old Davidson Cotton Mill complex has been transformed into offices, condominiums, and a restaurant.

Built Projects: City of Greensboro, Department of Housing and Community Development, North Carolina

Just one-and-a-half blocks from Greensboro's historic main street lies the innovative Southside redevelopment project. Once a blighted area, Southside has been transformed into a thriving district featuring historic buildings and vibrant public spaces, all within walking distance of downtown. The Southside neighborhood, a 10-acre revitalization project, is one of Greensboro's first significant mixed-use, infill projects. The project features 30 single-family homes, 10 two-family homes, 50 townhouses, 10 restored historic homes, and 20 live/work units where business owners live upstairs from their shop or office. Some residences include studio apartments above rear-detached garages, providing another housing choice. A public square serves as the neighborhood center. The city of Greensboro has contributed new sidewalks, historic streetlights, decorative brickwork, and landscaping. To facilitate the redevelopment process, the city's Department of Housing and Community Development developed a Traditional Neighborhood District Ordinance. All of the rehabilitated and new homes in the Southside district have sold out. What is more, the tax revenue generated for the city by the neighborhood is expected to rise from $400,000 before redevelopment in 1995 to an estimated $10 million once the development is completed.

The AIA Grants Housing Professional Interest Area (PIA) Awards

On March 19, 2004, the American Institute of Architects (AIA) announced the eleven recipients of the 2004 Housing Professional Interest Area (PIA) Awards. The AIA Housing PIA Awards Program, now in its fourth year, was established to recognize the best in housing design and promote the importance of good housing as a necessity of life, a sanctuary for the human spirit, and a valuable national resource. Two of the awards were granted to developments in Florida. The recipients of the 2004 awards were formally recognized in June at the 2004 AIA National Convention and Design Exposition in Chicago, Illinois.

Category: Community Design

Project: Belmont Heights Estates, Tampa, Florida

Architect: Torti Gallas and Partners—CHK, Inc., Silver Spring, Maryland

Client: The Tampa Housing Authority, Tampa, Florida

The Belmont Heights Estates in Tampa, Florida transformed a dismal and isolated public-housing project into an inviting mixed-income community, featuring 860 units with tree-lined streets, front porches, and civic gathering places. The design process for this development involved a week-long

charrette, during which residents voiced their needs and desires for their neighborhood. To encourage revitalization of the area, the community provides education, social and family development services, economic and personal-growth opportunities. The initiative constitutes the city's most significant neighborhood revitalization effort in the last 30 years.

Category: Single-family Custom

Project: Blue Ridge Farmhouse Addition, Washington, Virginia

Architect: Robert M. Gurney, FAIA, Architect, Alexandria, Virginia

Client: Robert and Elizabeth Haskell, Washington, Virginia

The Blue Ridge Farmhouse Addition is an 18th century white, clapboard farmhouse in the rolling hills of Virginia's Blue Ridge Mountains situated among 500 acres of stunning vistas. The architect has increased the clients' living space by adding a new living and entertaining area, bathroom, and changing facility. The thoughtfully designed space pays homage to the existing architecture. The glass and steel pavilion is transparent and linear, with a low-pitched roof matching that of the original farmhouse, which allows stunning views of the surrounding landscape and historic architecture.

ASLA Medal Awarded to the Mayor of the City of Charleston

In 2004, the American Society of Landscape Architects (ASLA) has awarded the Honorable Joseph P. Riley Jr., Honorary ASLA, Mayor of the City of Charleston, South Carolina, with the ASLA Olmsted Medal, for his environmental leadership, vision, and stewardship.The medal is named for Frederick Law Olmsted, the founder of the American landscape architecture profession and an early steward of the environment.

During his nearly 30 years in office, Mayor Riley has guided Charleston's downtown revitalization and historic restoration effort. At the same time, he has carefully planned for future development to ensure protection of the built and natural environments. Mayor Riley has worked tirelessly to restore existing parks and create new projects to draw the public back to the waterfront. Mayor Riley also serves as president of the U.S. Conference of Mayors and has created the Mayor's Institute for City Design, which has provided design education for hundreds of mayors, showing them how to shape the public realm and improve the quality of life for citizens.

2004 Master's and Ph.D. Project Titles

The following is a list of Master's Project and Ph.D. dissertation titles prepared by students who graduated from the Department of City and Regional Planning at UNC-Chapel Hill in May and August of 2004. To obtain a copy of one or more of these projects, contact Carolyn Turner at (919) 962-4784.

Master's Project Titles

DAVID ANSPACHER
Rail Feeder Shuttles: Who Will Use Them?

CLAY BARKLEY
A Guidebook For Mitigating Potential Inlet Hazards In the Outer Banks of North Carolina

ELLEN BECKMAN
The Handbook of Tools and Techniques for Coastal Inlets Management

MARCUS BECTON
Mixed-Income/Mixed Finance Developments: Meeting Policy Rationales and Fulfilling Goals or Falling Short of Expectations?

JODY BERWICK
Identifying Criteria for Effective Regional Economic Development Organizations in The United States

NAOMI CYTRON
Putting Infill to Work as a Community Development Strategy: The Franklin – Portland Gateway

MATTHEW DAY
Chapel Hill Town Center Alternative Transportation Level of Service

HEATHER DEUTSCH
Walltown: The History of a Neighborhood and a Housing Renovation Program

CHRISTINE EDMONSON
The Role That Volunteer Monitoring Plays in Watershed Planning and an Evaluation of the USDA Stream Visual Assessment Protocol in the Booker Creek Watershed

KATHERINE ESCHELBACH
Statewide Risk Assessment Methodology for the North Carolina Natural Hazard Mitigation Plan

SAMUEL EYRE
Low-Income Housing Tax Credits and Private Activity Bonds: A Guide to Affordable Housing Development

SUSAN FAULKNER
What Should We Do With Our Cars While We Take the Train?

JENNIFER GENZLER
Roaster Decision-Making for Coffee Certification Specialty Coffee Roasters in the North Carolina Triangle Region

JEREMY GOLDSTEIN
Zoning Alternative: Current Trends and New Direction

MICHAEL HAYES
Mental Health and Low Income Housing: Designing a Healthier Environment

LEANNA HUSH
An Evaluation of State Coastal Program Efforts at Hazard Mitigation Through the Coastal Zone Management Act

RACHEL JOHNSON
University Growth Plans: The Effects of Collaboration on Smart Growth Content: A Case Study of the University of North Carolina and North Carolina State University

GRETCHEN KOSARKO
The Geography of Opportunity and Programmatic Approaches for Enhancement in Milwaukee, Wisconsin

KELLY LOWRY
Smart Connections: Green Affordable Housing and City Planning

KARL MONAST
Neighborhood Quality Assessment

ROBYNN MORAITES
A Critical Examination of North Carolina's Historic Preservation Statute

KEIR MORTON
An Evaluation of the North Carolina Community College System's Pre-Homeownership Counseling Program

HELEN O'SHEA
Growing with Green Space Creating Neighborhood Parks Through the Development Process

GILLIAN ROSS
Are Communities in the Triangle Ready to do Their Fair Share? Developing a Regional Affordable Housing Strategy

ELIZABETH RUDD
Micro Credit and Women's Well Being: Grameen Bank as Compared to Work Force Opportunities in Bangladesh

JANE SIBLEY
Engaging Faith-Based and Community Organizations in the Local Hazard Mitigation Planning Process

ANDREW SPROUSE
Historic Preservation and Workforce Housing in North Carolina

RICHARD THORSTEN
Does Private Sector Participation Improve Water Utility Performance? A Literature Review and Analysis of Water Utilities in Asia

ASHLEY WEBER
Inner City Purchasing Power: A Case Study on The Jeffvanderlou Neighborhood in the City of St. Louis Missouri

STEVEN WERNICK
Telecommuting: Working From Home in the 21st Century

WILLIAM YEAGER
Infill Development and Research Parks: A Case Study of the Piedmont Triad Research Park

MICHELLE KORNBERG
Rethinking the Outmoded Industrial City: Inferences From Los Angeles' Policy Documents and Practical Application

ZACH SEAL
Assessing the Socioeconomic and Property Valuation Impacts of Tax Increment Finance Districts in Los Angeles

Ph.D. Dissertation Titles

SHANNON VAN ZANDT
Achieving the American Dream: The Impact of Homeownership on Opportunity for Low- and Moderate-Income Individuals

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